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(54) NONAQUEOUS SECONDARY BATTERY AND MANUFACTURE THEREOF

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a nonaqueous secondary battery which hardly makes an organic solvent flow out from a battery container even when the battery is broken, which has high safety, less deterioration in performance caused by charging/discharging cycles by using a gelled nonaqueous electrolyte.

SOLUTION: For example, ethylene carbonate is used as a solvent, vinylene carbonate and azobis isobutyronitrile are dissolved in ethylene carbonate, the solution obtained is impregnated in a positive material, a negative material, and a separator under reduced pressure, and block polymerization is conducted in a nitrogen atmosphere at 60° C for 20 hours. In this process, gel containing ethylene carbonate is filled in micropores of the both electrodes and the separator. Then, they are immersed in a solution prepared by dissolving LiPF₆ in ethylene carbonate to diffuse the gel, and thereby, the gel containing electrolyte is filled between electrodes.

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CLAIMS

[Claim(s)]

[Claim 1] A nonaqueous rechargeable battery characterized by using a gel nonaqueous electrolyte.

[Claim 2] A cell by which a gel nonaqueous electrolyte contains a polymerization object of a monomer in claim 1.

[Claim 3] A lithium ion battery whose nonaqueous electrolyte is an inflammable organic solvent in claim 1 or claim 2.

[Claim 4] A manufacturing method of a nonaqueous rechargeable battery characterized by making this gel after making a monomer solution with a nonaqueous electrolyte liquefied to at least one of this electrolytic solution, and compatibility of positive-electrode material, negative-electrode material, and a separator sink in.

[Claim 5] A manufacturing method made to gel by making a nonaqueous electrolyte containing a monomer sink in in claim 4, and making a polymerization reaction perform the back.

[Claim 6] A manufacturing method of a lithium ion battery whose nonaqueous electrolyte is an inflammable organic solvent in claim 4 or claim 5.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] Especially this invention relates to the lithium ion battery using the new electrolytic solution excellent in safety and endurance, and its manufacturing method about a nonaqueous rechargeable battery and its manufacturing method.

[0002]

[Description of the Prior Art] Since the energy density is high, it is briskly used as a power supply of a portable electronic device, and as for the nonaqueous rechargeable battery, for example, a lithium ion battery, development is furthered also as a power supply further for electric vehicles. By this kind of cell, using the carbon with which INTAKARESHON of a lithium happens to a negative electrode, the separator of the shape of a porous film is inserted into a positive electrode in the meantime using the multiple oxide of oxides, such as Co, nickel, and Mn, and a lithium, and it has composition dipped in the ethylene carbonate which is an organic solvent about these three persons into the electrolytic solution which melted the LiPF₆ grade which is an electrolyte. However, this cell used the inflammable organic solvent as an electrolytic solvent, when a cell was damaged or there was a seal by being imperfect, this organic solvent flowed out out of the container, and it ignited, and it had the defect with the danger of becoming a fire.

[0003] Moreover, in connection with the charge and discharge of a cell, there was a problem on which an opening is generated among two poles, or positive-electrode material and negative-electrode material produce blinding of a separator with a volume change in a lifting and this slightly, and the capacity and internal resistance of a cell deteriorate.

[0004]

[Problem(s) to be Solved by the Invention] In view of this trouble, this invention aims at offering a nonaqueous rechargeable battery with little [a possibility that an organic solvent will flow out out of a container is small, therefore safety is high and] deterioration accompanying charge and discharge, even when a cell is damaged.

[0005]

[Means for Solving the Problem] This invention is the manufacturing method of a nonaqueous rechargeable battery which makes this gel, after making a monomer solution with the electrolytic solution liquefied to at least one or this electrolytic solution, and compatibility of a nonaqueous rechargeable battery which used a gel nonaqueous electrolyte and positive-electrode material, negative-electrode material, and a separator sink in. In order to make a nonaqueous electrolyte gel, dissolve vinylene cull BONATO and azobisisobutyronitril by using ethylene carbonate as a solvent, this is made to decompress and sink into positive-electrode material, negative-electrode material, and a laminate of a separator, and 60-degreeC and a 20-hour bulk polymerization reaction are made to perform in nitrogen-gas-atmosphere mind. It generates so that gel containing ethylene carbonate may be filled up into a detailed hole of two poles and a separator by this. Then, gel filled up with between two poles including an electrolyte will be obtained by making it dipped and spread in an ethylene carbonate solution which melted LiPF₆ of an electrolyte. Moreover, a monomer and a polymerization initiator may be made to dissolve and react to a nonaqueous solvent which dissolved an electrolyte beforehand.

[0006]

[Effect of the Invention] Since according to the cell of this invention, and its manufacturing method a passage clear from the above explanation the electrolytic solution does not have a fluidity when a cell can is damaged, a nonaqueous rechargeable battery with little [the danger of the fire accompanying the outflow of the electrolytic solution is small, and] deterioration accompanying charge and discharge is obtained.

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(54) 【発明の名称】 非水系二次電池およびその製造法

(57) 【要約】

【課題】 可燃性の有機溶媒を電解質の溶剤として用いた電池が破損した場合の火災の危険性を減少させる。

【解決手段】 ゲル状の非水系電解液を用いる。

【特許請求の範囲】

【請求項1】ゲル状の非水系電解液を用いたことを特徴とする非水系二次電池。

【請求項2】請求項1において、ゲル状の非水系電解液がモノマーの重合物を含む電池。

【請求項3】請求項1または請求項2において、非水系電解液が可燃性有機溶剤であるリチウムイオン電池。

【請求項4】正極物質、負極物質、セパレーターの少なくとも一つに液状の非水系電解液または該電解液と相溶性のあるモノマー溶液を含浸せしめた後、これをゲル化せしめることを特徴とする非水系二次電池の製造法。

【請求項5】請求項4において、モノマーを含む非水系電解液を含浸せしめて後、重合反応を行わせることにより、ゲル化せしめる製造法。

【請求項6】請求項4または請求項5において、非水系電解液が可燃性有機溶剤であるリチウムイオン電池の製造法。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は非水系二次電池およびその製造法に関し、特に安全性と耐久性に優れた新規な電解液を用いたリチウムイオン電池およびその製造法に関するものである。

【0002】

【従来の技術】非水系二次電池、例えばリチウムイオン電池はそのエネルギー密度が高いことから、携帯用電子機器の電源として盛んに使われており、更に電気自動車用の電源としても開発が進められている。この種の電池では、負極にはリチウムのインターカーレーションの起こるカーボンを用い、正極にはCo、Ni、Mn等の酸化物とリチウムとの複合酸化物を用い、この間に多孔質の膜状のセパレーターを挟み、この3者を有機溶剤であるエチレンカーボネート等に電解質であるLiPF₆等を溶かした電解液中に浸した構成になっている。しかしながら、この電池は可燃性の有機溶媒を電解質の溶剤として用いており、電池が破損したり、シールが不完全で有ったりした場合には、この有機溶媒が容器の外に流出

して引火し、火災になる危険性がある欠点があった。

【0003】また、電池の充放電に伴い、正極物質や負極物質が僅かに体積変化を起こし、これに伴い両極間に空隙が生じたり、セパレーターの目詰まりを生じたりして電池の容量や内部抵抗が劣化する問題があった。

【0004】

【発明が解決しようとする課題】本発明は、かかる問題点に鑑み、電池が破損した場合でも有機溶媒が容器の外に流出する可能性が小さく、従って安全性が高く、且つ充放電に伴う劣化の少ない非水系二次電池を提供することを目的とする。

【0005】

【課題を解決するための手段】本発明は、ゲル状の非水系電解液を用いた非水系二次電池、および、正極物質、負極物質、セパレーターの少なくとも一つに液状の電解液または該電解液と相溶性のあるモノマー溶液を含浸せしめた後、これをゲル化せしめる非水系二次電池の製造法である。非水系電解液をゲル化せしめるには、例えばエチレンカーボネートを溶媒として、ビニレンカルボナートとアゾビスイソブチロニトリルを溶解し、これを正極物質、負極物質、及びセパレーターの積層品に減圧して含浸せしめ、窒素雰囲気中で60℃、20時間塊重合反応を行わせる。これにより、エチレンカーボネートを含んだゲルが両極およびセパレーターの微細な孔の中まで充填する様に生成する。その後、電解質のLiPF₆を溶かしたエチレンカーボネート溶液中に浸して拡散せしめることにより電解質を含んで両極間を充填したゲルが得られることになる。また、予め電解質を溶解した非水系溶媒にモノマーと重合開始剤を溶解して反応させても良い。

【0006】

【発明の効果】以上の説明から明らかな通り、本発明の電池およびその製造法によれば、電池缶体が破損した場合、電解液が流動性を持たないため、電解液の流出に伴う火災の危険性が小さく、且つ充放電に伴う劣化の少ない非水系二次電池が得られるものである。